

# Plant Dwarfing Technologies Novel Concepts for Food Augmentation in Space Project

Center Innovation Fund: KSC CIF Program | Space Technology Mission Directorate (STMD)



## ABSTRACT

This project proposes to evaluate perennial woody fruit species, and in particular, genetically modified plum trees for inclusion as a crop for Advanced Life Support (ALS) system designs. Testing is being carried with USDA developed plums that have the FT flowering gene overexpressed. This genetic transformation resulted in shorter growing (dwarf) plants that flower very early in growth, and also eliminated the need for a cold, dormancy periods to induce flowers. These attributes are all desirable for space flight, where volume and time to production are constraints. If successful, this could allow the dwarf plums to be tested in space as a source of fresh fruit to supplement the crew's diet. An additional consideration is that dried plums have been shown to act as a countermeasure to bone density loss, which is a problem for humans in microgravity settings. The current testing is exploring the horticultural requirements for growing and propagating the genetically modified plums in controlled environments similar to what might be encountered in space. Testing to date has identified several desirable genotypes (short and reliable flowering types), developed a reliable approach cloning and rooting these genotypes, and shown that these genetic lines are tolerant to continuous light and elevated CO<sub>2</sub>. Further testing of these responses to elevated CO<sub>2</sub> and production trials are underway.

## ANTICIPATED BENEFITS

### To NASA funded missions:

Findings from this work could help future NASA exploration missions where in situ food production would be beneficial.

### To NASA unfunded & planned missions:

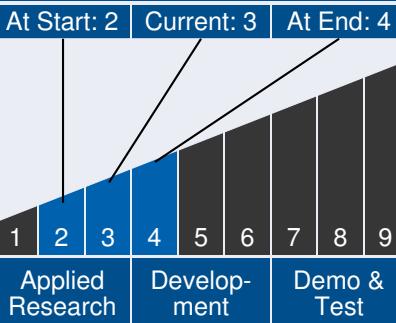
Future exploration missions where bioregenerative life support capabilities become more important.



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## Technology Maturity



## Management Team

### Program Director:

- John Falker

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## To other government agencies:

Successful testing of the dwarf plum trees in controlled environments to allow them to be considered for terrestrial greenhouse production or even more advanced urban/vertical agriculture systems. The lack of dormancy requirements could also allow their use in warmed climates for field agriculture

## To the nation:

Successful testing of the dwarf plum trees in controlled environments to allow them to be considered for terrestrial greenhouse production or even more advanced urban/vertical agriculture systems. The lack of dormancy requirements could also allow their use in warmed climates for field agriculture

## DETAILED DESCRIPTION

This project proposes to evaluate perennial woody fruit species, and in particular, genetically modified plum trees for inclusion as a crop for Advanced Life Support (ALS) system designs. Testing is being carried with USDA developed plums that have the FT flowering gene overexpressed. This genetic transformation resulted in shorter growing (dwarf) plants that flower very early in growth, and also eliminated the need for a cold, dormancy periods to induce flowers. These attributes are all desireable for space flight, where volume and time to production are constraints. if successful, this could allow the dwarf plums to be tested in space as a source of fresh fruit to supplement the crew's diet. An additional consideration is that dried plums have been shown to act as a countermeasure to bone density loss, which is a problem for humans in microgravity settings. The current testing is exploring the horticultural requirements for growing and propagating the genetically modified plums in controlled environments similar to what might be encountered in space. Testing to date has identified several

## Management Team (cont.)

### Program Executive:

- Karen Thompson

### Program Manager:

- Nancy Zeitlin

### Project Manager:

- Raymond Wheeler

### Principal Investigator:

- Raymond Wheeler

## Technology Areas

### Primary Technology Area:

Human Exploration Destination Systems (TA 7)

└ Food Production, Processing, and Preservation (TA 7.2.4)

### Other Technology Areas:

- Human Health, Life Support & Habitation Systems (TA 6)
- Long-Duration Health (TA 6.3.2)

Active Project (2014 - 2015)

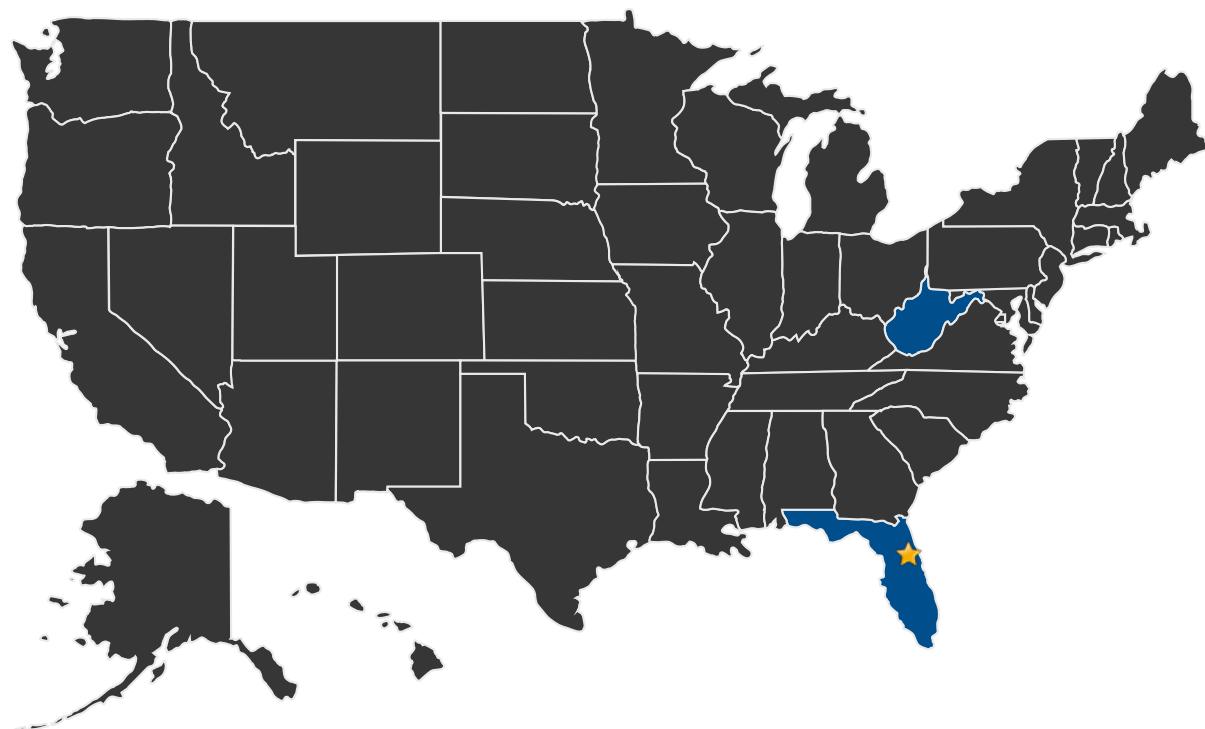
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## U.S. LOCATIONS WORKING ON THIS PROJECT



■ U.S. States With Work

★ Lead Center:

Kennedy Space Center

## Other Organizations Performing Work:

- USDA, Agricultural Research Service

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## DETAILS FOR TECHNOLOGY 1

### Technology Title

Fruit trees as space crops.

### Technology Description

This technology is categorized as a hardware component or part for other applications

The technology would be a new class of plants / crops that could be used for food production for human space exploration.

### Capabilities Provided

This would provide a capability to generate high value, fresh fruit on a sustained basis for space exploration.

### Potential Applications

The technology could be used for near term ISS missions (LEO), transit mission to near-Earth objects, or planetary surface outposts to help provide food and oxygen for the crew.

### Performance Metrics

Metric	Unit	Quantity
Demonstrate success production of plum fruit in controlled environments.		